

**PHASE 1 PALAEOLOGICAL
ASSESSMENT AND "CHANCE FIND
PROTOCOL" FOR THE PROPOSED SORATA
-WITSIESHOEK (ESKOM HOLDINGS (PTY)
LTD) POWER LINE CONSTRUCTION,
MALUTI-A-PHOFUNG LOCAL
MUNICIPALITY, THABO MOFUTSANYANE
DISTRICT MUNICIPALITY, FREE STATE
PROVINCE**

FOR

HIA CONSULTANTS

Margen Industrial Services

DATE: 13 November 2017

By

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EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Assessment and “Chance Find Protocol” for the proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line construction, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province.

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (amended 2014, 2017). In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

The development site for the proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line upgrade, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province is underlain by Permian to Triassic aged sedimentary rocks of the Normandien Formation of the Adelaide Subgroup and the Katberg and Burgersdorp Formations of the Tarkastad Subgroup, Beaufort Group, as well as Jurassic aged igneous dolerite of the Drakensberg Group, Karoo Supergroup as well as Quaternary aged alluvium.

Significant plant, vertebrate and invertebrate trace fossils are well-known from the study area and highly significant trackways of fossils were observed during recent field investigations. The potential for finding significant fossils in any excavation into sediments of the Normandien, Katberg and Burgersdorp Formations is Very High, with potential to find fossils in the alluvium rated as Moderate. Significant new fossils were observed during recent field assessment into these rocks and a short information session must be arranged to inform the site managers and ECO of the fossils that might be expected. If fossils are observed during construction, the HIA consultant must be notified and the fossils must be collected by a suitably qualified palaeontologist. No fossils will be associated with areas underlain by dolerite.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High Palaeontological sensitivity is retained for the sections of the development that is underlain by shale and sandstone of the Normandien, Katberg and Burgersdorp Formations and a Moderate sensitivity is retained for

alluvium. Although highly weathered, fossils might be recorded during the initial phase of construction.

- A Professional Palaeontologist must be appointed to inspect the site during the very first week of construction and then at least once a month during the on-going weeks of excavation for the infrastructure and a “Chance Find Protocol” document (CFP, included with this report) must be updated on a monthly basis. If fossils are recorded, a suitably qualified palaeontologist must be appointed to inspect all areas where excavation of deeper than 1,5m is made into sediments of Normandien, Katberg and Burgersdorp Formations and a protocol for the chance find of fossils must then be developed and discussed with the contractor on site. This action is needed once a month for the duration of the excavation activities. It should take only one day per month of consultation time.
- These recommendations must be included in the EMP of this project.

CHANCE FIND PROTOCOL FOR PALAEONTOLOGICAL HERITAGE

Proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line upgrade, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province

Mitigation for Excavation Impact on Palaeontological Heritage Resources

It is essential that the appointed palaeontologist, in consultation with the Project Manager of the excavation works and Margen develop a short-term strategy for the recovery of significant fossils during the excavation operation. This assessment can only be done once the excavations have started and the financial implications are relatively small as the Palaeontologist only needs to visit the site once to inform the contractors of what they must look out for and then be informed by the ECO if any “unforeseen” fossils are reported.

The development site for the Proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line construction, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province, falls on Highly significant shale and thin bands of sedimentary rocks (Normandien, Katberg and Burgersdorp Formations) and Moderately sensitive (alluvium) sediments, that might contain significant fossils. No fossils are expected in the dolerite.

Fossils have been recorded for years in these rock formations. The potential for finding significant micro-fossils mostly as trace fossils, as well as macro fossils in the form of plant and vertebrate remains, in any excavation into sediments of the Normandien, Katberg and Burgersdorp Formations, is always very high and the cooperation of the entire team at Sorata-Witsieshoek Power Line Upgrade Project is of critical importance. The interest and cooperation of the management team will be highly appreciated and it is essential that the excavation be monitored during the first week of excavation and that this “Chance Find Protocol” be updated on a monthly basis during the life-time of the excavation period for the project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the “Chance Find Protocol” on the SAHRIS Website for record purposes. No fossils will be associated with areas underlain by dolerite, but significant Quaternary aged fossils can be present in the alluvial cover on these geological formations.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity was allocated to the greater part of the development and due to the highly weathered nature of the material, significant fossils are only expected **after** the start of excavations for foundations.
- The allocated team members at the community need to be introduced to Palaeontological material that is likely to be found on site. A once-off information session with the Palaeontological specialist must be arranged, to present a simple and understandable, preferably audio-visual presentation, in the “interpreted voice” of the majority of the contractual workers on site, during the initial site visit. This arrangement must form part of the EMPr for the project, with an appropriate budget allocation.
- This “Chance Find Protocol” needs to be included into the EMPr of the project and a reasonable budget need to be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The SAHRA must be informed of the content of this “Chance Find Protocol” and EMPr arrangements by the EAP, ECO and the developer, for final approval of the ROD documentation during the EIA process.

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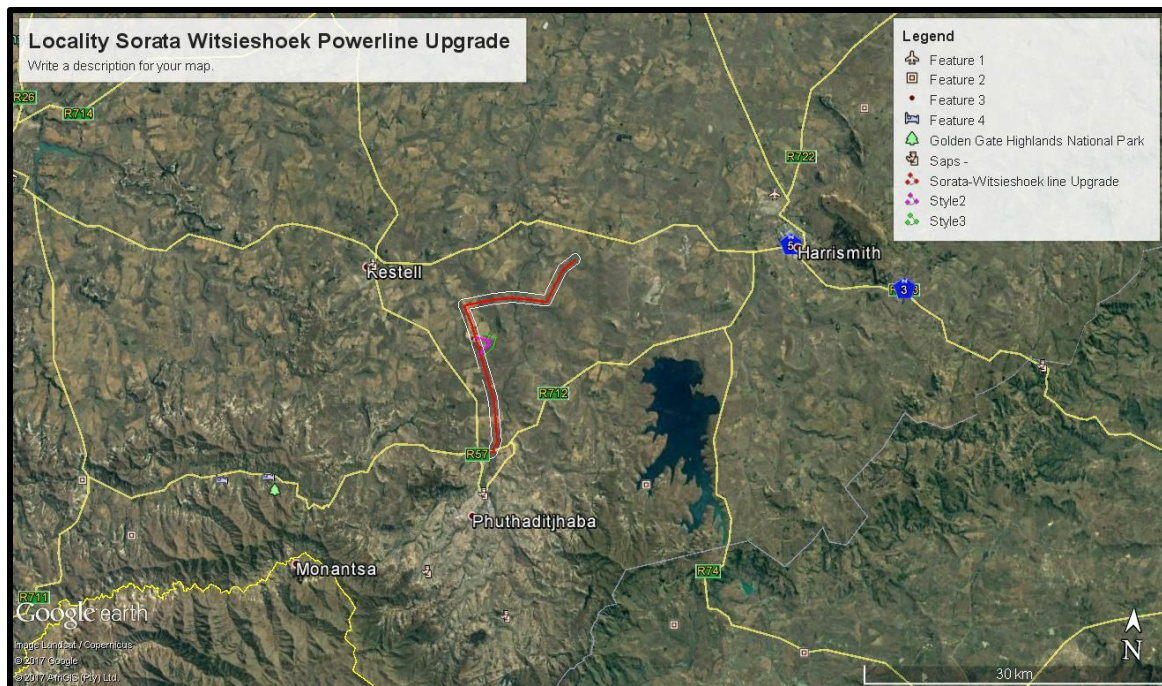
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INTRODUCTION

Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Assessment and “Chance Find Protocol” for the proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line upgrade, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province (figure 1).



(Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint..

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A Phase 1 investigation is often the last opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

Following the "SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

- to identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assessing the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

Prior to the field investigation a preliminary assessment (desktop study) of the topography and geology of the study area was made using appropriate 1:250 000 geological maps (2828 Harrismith) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) were identified within the study area and the known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas were identified within the development footprint to focus the field investigator's time and resources. The aim of the fieldwork was to document any exposed fossil material and to assess the

palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008, 2009) (Groenewald et al., 2014).	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.

BLUE	<p>Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in larger alluvium deposits. At least one site visit by a competent palaeontologist is compulsory. Collection of a representative sample of potential fossiliferous material is recommended.</p>
GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least one site visit by a suitably qualified palaeontologist is recommended.</p>

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

Scope and Limitations of the Phase 1 Investigation

The scope of a phase 1 Investigation includes:

- an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, location and examination of any fossil collections from the study area (e.g. museums).
- an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation focussed on the bedrock exposure where excavations would most probably require palaeontological monitoring.

The results of the field investigation are used to predict the potential of buried fossil heritage within the development footprint. In some investigations, this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

Locality and Proposed Development

The Sorata-Witsieshoek Power Line Upgrade is situated to the east of Kestell in the Thabo Mofutsanyane Local Municipality. The upgrading is planned for the purpose of future supply of electricity to the Qwaqwa region.

This Phase 1 Palaeontological Impact Assessment is specifically aimed at the proposed development of the Power Line Construction activity.

The Sorata-Witsieshoek Line activity forms part of the upgrading of the electrical supply to Qwaqwa and the construction activities might expose some significant outcrop of the underlying geological formations. The site falls in the very well preserved grassveld ecosystem of the Eastern Free State Province and outcrops are restricted to very deep weathering and erosion features.

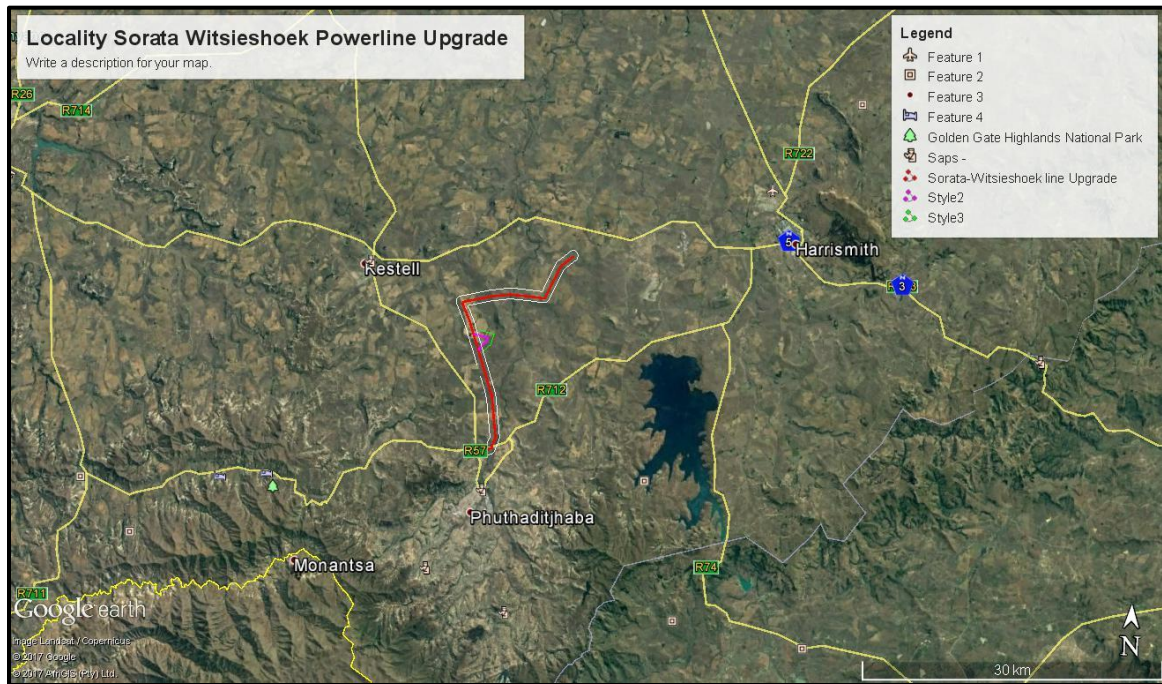


Figure 2 Proposed development footprint north of Phuthaditjhaba in the Free State

GEOLOGY

The study area is underlain by Permian and Triassic aged sedimentary rocks of the Beaufort Group as well as Jurassic aged dolerite of the Karoo Supergroup and Tertiary aged alluvium, (Figure 3).

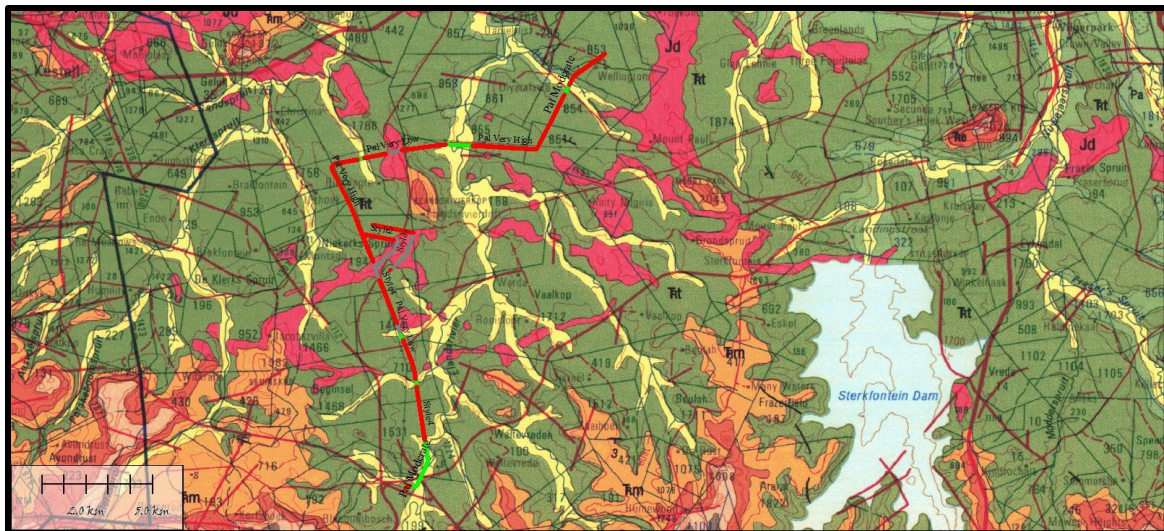
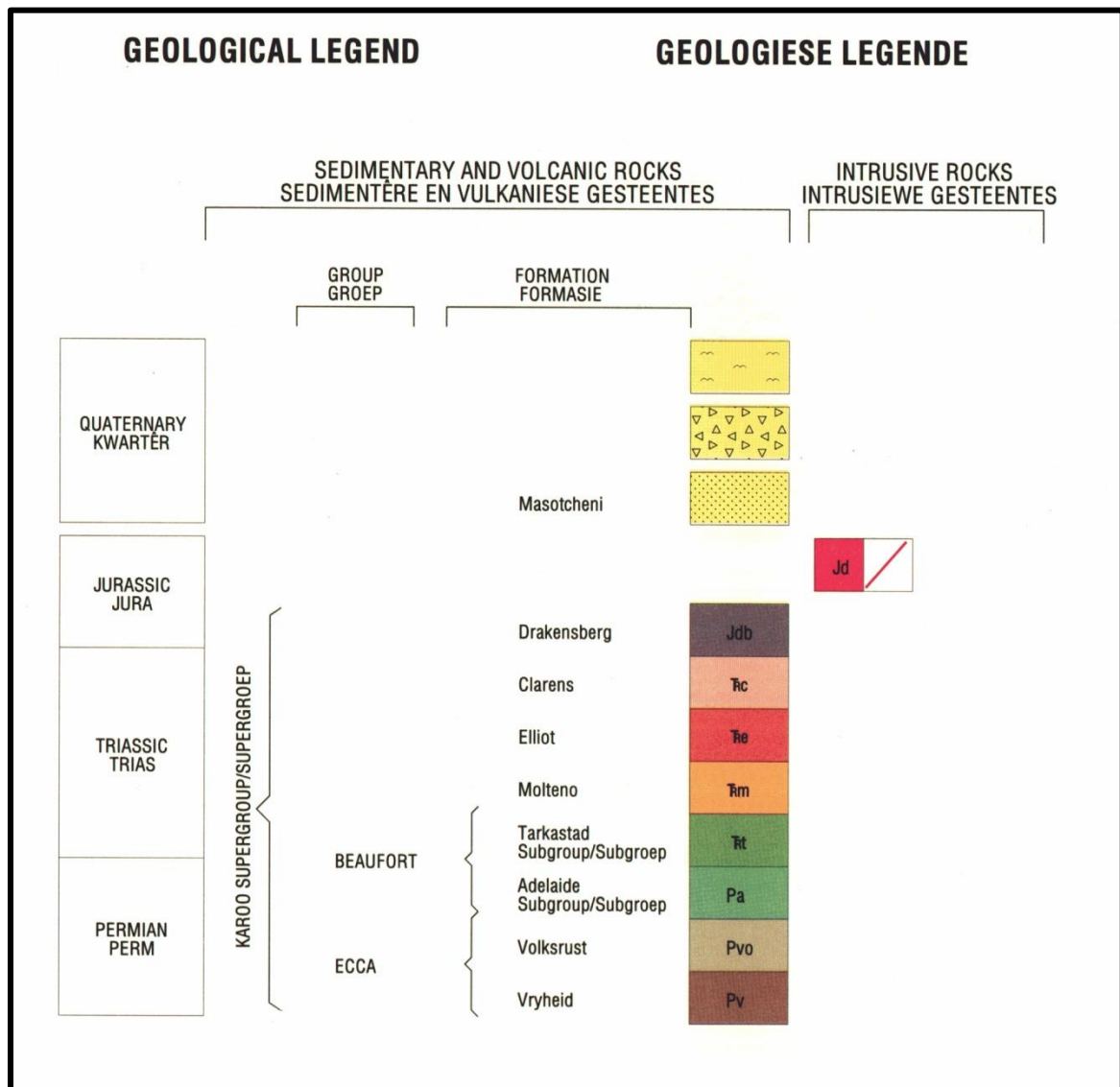


Figure 3 Geology of the area underlying the linear development



Karoo Supergroup,

Beaufort Group

Adelaide Subgroup (Pa)

Normandien Formation (Pn)

Adelaide Subgroup [Estcourt Formation (Pe) pre 2015] Normandien Formation (Pn, post 2015)] name equivalents on maps of the Council for Geoscience)

The Permian to Triassic aged Normandien Formation (also mapped as the Adelaide Subgroup [Pa] and Estcourt Formation [Pe] on older versions of 1:250 000 sheets of South Africa) underlies the entire study area (Figure 3). The Formation consists of a series of fluvial sandstone and mudstone, representing the first influx of fluvial sediments into a dominantly deltaic environment of the upper Ecca Group (Groenewald 1989; 1996; Johnson et al, 2009; Groenewald, 2011; Groenewald et al, 2014).

The Normandien Formation has been subdivided into distinctive Members by Groenewald (1990) but these members were not mapped in the study area. The most distinguishable upper, brightly colored and red mudstone Member, named the Harrismith Member (Johnson et al 2009) forms the upper part of the Normandien Formation and can be correlated with the Palingkloof Member of the Balfour Formation of the Adelaide Subgroup in the southern part of the Karoo Basin (Groenewald, 1996).

Tarkastad Subgroup (Trt)

Katberg Formation (Trk) / Verkykerskop Formation (Trv)

The Katberg Formation is an arenaceous unit that forms the base of the Tarkastad Subgroup (Groenewald 1996; Johnson et al, 2009). The study area comprises the region where the Katberg Formation (fine grained sandstone) is interbedded with the dramatically coarser grained sandstone of the time equivalent Verkykerskop Formation of Groenewald (1984, 1989) also summarized in Johnson et al 2009).

The Triassic aged Katberg Formation represents a distal and the Verkykerskop Formation a proximal fluvial braided river environment with influx of sediment from the east and south-east during the early Triassic. The climate was

still extremely dry but the influx of large volumes of water along well-defined very large channels dominated the fluvial environment (Groenewald 1996).

Burgersdorp Formation (Trb) / Driekoppen Formation (Trd)

The Triassic aged Driekoppen Formation (Groenewald 1990; Johnson, 2009) is a time equivalent of the proximal Burgersdorp Formation to the south in the Karoo Basin (Groenewald, 1996).

The Driekoppen Formation represents a very important lacustrine environment in this distal part of the Karoo Basin and bears evidence of extensive meandering river channels in a dominantly low sinuosity fluvial environment with evidence of population by several plant and animal species that characterises the palaeo-environment of the Karoo Basin during the Early Permian.

Dolerite (Jd)

Jurassic aged dolerite dykes and sills represent a volcanic episode that occurred during the breakup of Gondwanaland.

Masotcheni Formation and Alluvium

The Quaternary aged Masotcheni Formation is a sandy to clay-rich Quaternary aged deposit of sediments that collect during sheetwash or covering of the footslopes of the hills during colluvial movement of sediments over the entire study area (Jonson et al, 2009). Although the alluvium deposits are not indicated on the 1:250 000 scale geological sheet 2828 Harrismith, the sediments are very important indicators of the 100 year flood line of the rivers, and the developer must be very aware of the fact that some of the points indicated for development of power line facilities falls well within this flood line. It is very urgently recommended that the developer ensure proper planning of the crossing of these wetland areas during construction of the power lines. Bad planning of power line crossings can lead to exposure of dispersive and expansive sediments with a very high risk of unwanted erosion and tunneling. Although not part the brief for this investigation, these extreme formation of dongas can result in significant exposure of Palaeontological Heritage in the long run.

PALAEONTOLOGY

The Palaeontology of the study area is very well represented and discussed in the Desktop Survey completed for this project (Durant, 2017). It is not feasible to repeat the information in this report, but, for the sake of completeness, the observations of the author is addressed as an addition to the comments by Dr

Durant. The fact that the area is very well known to the author must be seen as the main reason for deviating from the normal procedures for a Phase 1 site inspection before the commencement of the construction activities, but rather a recommendation that the Phase 1 site inspection and collection of fossils be postponed to the first week of construction for the project as part of the Budget allocated for the Phase 1 PIA study. This recommendation must form part a parcel of the EMPr for the Project and the palaeontologist must train the ECO on site, plus visit the site continuously on a weekly basis during construction, to ensure that all fossils from the Triassic aged sediments are recorded timeously if exposed.

Karoo Supergroup

Beaufort Group

Adelaide Subgroup (Pa)

Normandien Formation (Pn)

The Permian to Triassic Normandien Formation (**Pa** in Figure 3) is Internationally known for the wealth of trace, plant and vertebrate fossils that is present in this Very Highly sensitive Palaeontological Zone of South Africa. The study area falls in the Permian Extinction time-zone (252 millions years ago) in South Africa and the Formation is home to the *Glossopteris* Assemblage of plants, the *Daptocephalus* and *Lystrosaurus* Assemblage Zones of Vertebrates as well as well-known trace fossils, including casts of vertebrate burrows (MacRae, 1999; McCarthy and Rubidge, 2005; Johnson et al 2009; Groenewald, 2011 and Groenewald et al 2014; Groenewald, 2016).



Figure 4 Skull of a reptile from the Daptocephalus Assemblage Zone

The most famous vertebrate fossils belong to the *Daptocephalus* (formally known as the *Dicynodon* Assemblage Zone) as well as the *Lystrosaurus* Assemblage Zones with good examples of fossil bones and a well-preserved skull roof (to be prepared and identified) discovered in KwaZulu-Natal during a recent study (Figure 4).

Very well preserved remains of insect wings are known from the nearby town of Estcourt (Van Dijk 2011, Johnson et al, 2009), and it will be very significant if some of these unique fossils can be discovered during excavations of foundations and trenches for this project.

Well-preserved petrified wood and other plant fossils were recorded in the vicinity of the study area (Figure 5) and these fossils contribute significantly to our understanding of the palaeo-environments that existed during the Late Permian, beginning of the Triassic periods in this part of the Karoo Basin (McCarthy and Rubidge, 2005).



Figure 5 Petrified tree fossils discovered during the building of the Ingula Pumped Storage Scheme near Harrismith during 2009

The Harrismith Member is very well known for the presence of extremely well-preserved remains of vertebrates belonging to the *Lystrosaurus* Assemblage Zone over the entire outcrop area of this unit in the Karoo Basin of South Africa (Johnson et al, 2009). The remains of *Lystrosaurus* sp were discovered at two sites associated with this this Project (Figure 6). The remains of this animal is also known from several sites in the study area (Figure 7).



Figure 6 Palaeontological reconstruction of a possible scene from the Permian and Early Triassic environments in the study area. (Metcalf www.pixy.com)



Figure 7 Example of a *Lystrosaurus* fossil from the Harrismith Member in the study area

Tarkastad Subgroup (Trt)

Verkykerskop Formation (Trv) / Katberg Formation (Trk)

The Triassic aged Verkykerskop Formation is dominantly a coarse-grained sandstone with a very prominent Fe-Mn enriched clast conglomerate at the basal contact with the Harrismith Member of the Normandien Formation (Groenewald, 1989). The Katberg Formation, as is mostly present in the study area of this project, consists mainly of fine-grained fluvial sandstone with very well-defined laminar cross-bedding (Figure 8) with very well-defined trackways of vertebrates preserved in the sandy surfaces (Figure 9).



Figure 8 Typical outcrop style of the Katberg Formation in the study area



Figure 9 Well-defined trackway of a vertebrate animal on the fine-grained sandstone of the Katberg Formation

Driekoppen Formation (Trd) / Burgersdorp Formation (Trb)

The Triassic aged Driekoppen Formation is a time equivalent of the Burgersdorp Formation in the southern part of the Karoo Basin (Groenewald, 1996) and the formation is characterised by low sinuosity fluvial as well as lacustrine palaeo-environments associated with the *Cynognathus* Assemblage Zone in the Karoo Supergroup (McCarthy and Rubidge, 2005; MacRae, 1999).

The most fascinating finds from this part of the Karoo Basin was the discovery of an intricate set of vertebrate burrows with the remains of *Trirachodon* proven to be the burrows of these lizards (Figure 10) as described by Groenewald et al, 2001).



Figure 10 Casts of vertebrate burrows from the Cynognathus Assemblage zone in the study area

Dolerite

Due to the volcanic nature of the rocks, dolerite will not contain fossils.

Masotcheni Formation and Alluvium

No fossils have to date been recorded from Quaternary aged sediments in this study area. Any new finds will contribute significantly to our understanding of the Quaternary age eco-systems in this part of Southern Africa.

PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity was predicted as highly significant, due to the potential abundance of Permian aged fossils in the Ecca Group as well as possible vertebrate fossils in the Alluvium. Dolerite will not contain any significant fossil remains.

FIELD INVESTIGATIONS

Dr Gideon Groenewald, experienced fieldworker who spent more than 30 years doing fieldwork in the vicinity of the study area, did a preliminary investigation on 13 November 2017 and confirms the presence of significant fossils in the area and finds it non-productive to do a physical site inspection before the onset of construction activities for this project. The conclusions of this Phase 1 investigation are based on a personal knowledge of the sites that will be affected by the construction and the deep soils and grass cover will render a site visit at this stage of the EIA process a waste of money. The EAP must however ensure that the recommendations of the “Chance Find Protocol” (CFP) document, that forms part of this Phase 1 PIA assessment, be adhered to in terms of the provision of funding for the completion of a Phase 1 PIA assessment during construction. A site visit by the Palaeontologist is included in the cost estimate of this preliminary Phase 1 assessment and the palaeontologist must be invited to come on site during the very beginning of the project to train the ECO and to record any new finds exposed during construction activities.

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information known to the author about this field site (Figure 5).

The preliminary investigation confirms that the study area is underlain by deeply weathered sediments of the Normandien Formation, as well as the Tarkastad Subgroup, dolerite and alluvium.

The excavations for the construction of the infrastructure for this development can expose some sediments of Very Highly and sensitive geological formations and some sites are known for significant fossil remains. A small part of the development might expose Dolerite that will not contain any fossils.

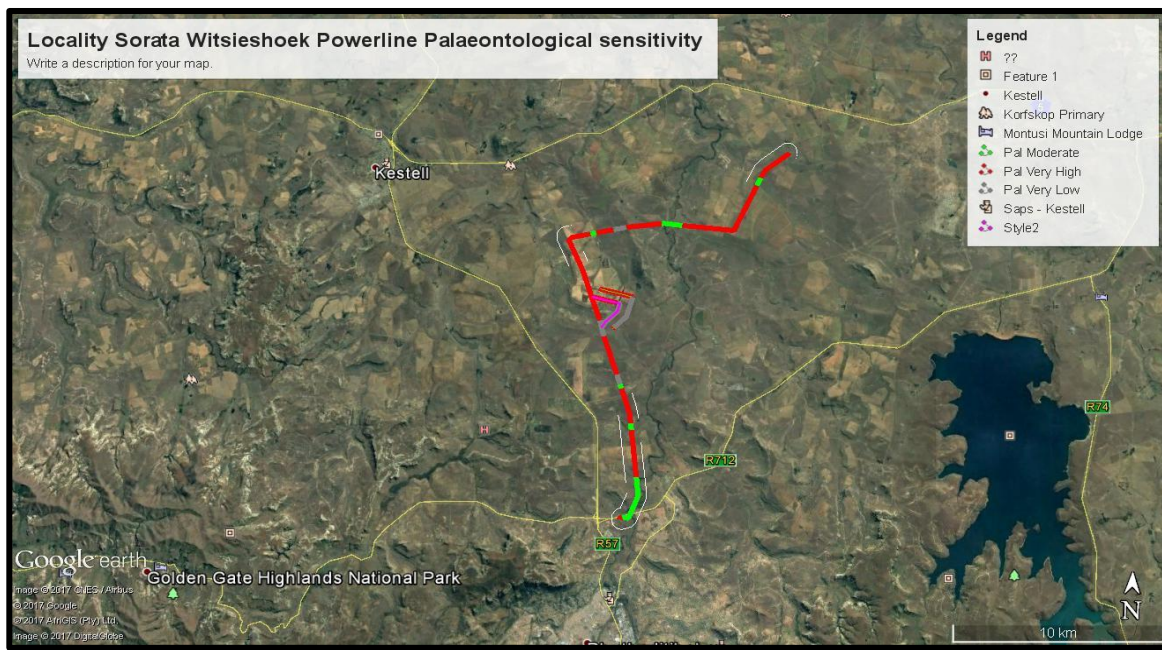


Figure 11 Palaeontological sensitivity of the rocks underlying the route of the Sorata-Witsieshoek Eskom Powerline. For colour coding see Table 1.

CONCLUSION

The development site for the proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line upgrade, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province is underlain by Permian to Triassic aged sedimentary rocks of the Normandien Formation of the Adelaide Subgroup and the Katberg and Burgersdorp Formations of the Tarkastad Subgroup, Beaufort Group, as well as Jurassic aged igneous dolerite of the Drakensberg Group, Karoo Supergroup as well as Quaternary aged alluvium.

Significant plant, vertebrate and invertebrate trace fossils are well-known from the study area and highly significant trackways of fossils were observed during recent field investigations. The potential for finding significant fossils in any excavation into sediments of the Normandien, Katberg and Burgersdorp Formations is Very High, with potential to find fossils in the alluvium rated as Moderate. Significant new fossils were observed during recent field assessment into these rocks and a short information session must be arranged to inform the site managers and ECO of the fossils are that might be expected. If fossils are observed during construction, the HIA consultant must be notified and the fossils must be collected by a suitably qualified palaeontologist. No fossils will be associated with areas underlain by dolerite.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High Palaeontological sensitivity is retained for the sections of the development that is underlain by shale and sandstone of the Normandien, Katberg and Burgersdorp Formations and a Moderate sensitivity is retained for alluvium. Although highly weathered, fossils might be recorded during the initial phase of construction.
- A Professional Palaeontologist must be appointed to inspect the site during the very first week of construction and then at least once a month during the on-going weeks of excavation for the infrastructure and a “Chance Find Protocol” document (CFP, included with this report) must be updated on a monthly basis. If fossils are recorded, a suitably qualified palaeontologist must be appointed to inspect all areas where excavation of deeper than 1,5m is made into sediments of Normandien, Katberg and Burgersdorp Formations and a protocol for the chance find of fossils must then be developed and discussed with the contractor on site. This action is a needed once a month for the duration of the excavation activities. It should take only one day per month of consultation time.
- These recommendations must be included in the EMP of this project.

CHANCE FIND PROTOCOL FOR PALAEONTOLOGICAL HERITAGE

Proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line upgrade, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province

Mitigation for Excavation Impact on Palaeontological Heritage Resources

It is essential that the appointed palaeontologist, in consultation with the Project Manager of the excavation works and Eskom develop a short-term strategy for the recovery of significant fossils during the excavation operation. This assessment can only be done once the excavations have started and the financial implications are relatively small as the Palaeontologist only needs to visit the site once to inform the contractors of what they must look out for and then be informed by the ECO if any “unforeseen” fossils are reported. As part of such a strategy, the discussions with the palaeontologist must include:

- Initially, and at least for the *duration of excavation*, visits to the site at least once (is this supposed to be once a month?), to ensure recording of all potentially significant fossil strata.
- Determine a short-term strategy and budget for the recording of significant fossils. This Strategy is simply an oral agreement on when the site is to be inspected and what the finds are that might be recorded. The site visit must include an introduction session with all the managers of the Project Team, including training of the ECO and site managers by the appointed palaeontologist, to basically train people to know what to look out for in terms of fossil heritage on site.
- In the case of any unusual structures, the Palaeontologist must be notified, and a site visit must be arranged at the earliest possible time with the Palaeontologist. In the case of the ECO or the Site Manager becoming aware of suspicious looking material that might be a “Significant Find”, the construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues. Significant finds were recorded for years in this area by the author of this document (Phase 1 PIA).

Mitigation Measures Normally Encountered

1. Mitigation of palaeontological material must begin as soon as possible and preferably when “trial excavation” takes place. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.

2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the Evolutionary Studies Institute (ESI) at WITS University, which is the closest Institute to the site. If appropriate, the National Museum in Bloemfontein as well as the University of the Free State (Qwaqwa Campus) might be asked for their involvement in this project.

3. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the ECO and Eskom Holdings (Pty) Ltd

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the excavation operation. This is a simple storing space (secure box) where the ECO can keep suspicious looking rocks for inspection by the Palaeontologist during the site visits.

2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas. The Palaeontological specialist will remove all significant fossils after every visit, and the chance find of vertebrate fossils is very high. The trace fossils will be in slabs of rock that will be removed after each site visit. Only “representative” samples will be collected after which a “destruction permit” will be implemented to allow for destruction of the rest of the fossils – no further mitigation will be required and the costs will be mainly a once-off assistance to cart rocks to the Contractors “site office” with a suitable vehicle. In the case of this project, it is foreseen that vertebrate and plant fossils will be present. *(If trace fossils of Permian and Triassic age are exposed, it will be very Highly significant and the Palaeontologist will obviously be in close communication with the ECO to act as required by SAHRA without causing undue standing time for the contractors).*

3. “Facilitate” systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by allowing time to describe and measure geological sections, and by providing aid in the surveying of positions where significant fossils are found. This procedure involves coordination between the Palaeontologist and the ECO, with very little

additional costs to the developer. *(In the case of this specific development, the likelihood of such finds is very high).*

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds. This can be a container or cardboard box used for this purpose.

5. Provide covered, dry storage for samples and facilities that is defined as a work area for sorting, labelling and boxing/bagging of samples. This is a small part of the normal storeroom facility at the site office. No big (larger than 5m) fossils are expected. *Lystrosaurus* fossils expected are normally up to 1m long and 0.75m wide.

6. Costs of basic curation and storage in the sample archive at the ESI, WITS University (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees). The cost for this requirement is mainly the delivery costs to Bloemfontein or Johannesburg by light vehicle. It is normally combined with normal traveling arrangements for persons from the development site.

Documentary record of palaeontological occurrences – the Contractor

1. The contractor will in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which the following information will be indicated on the plan in the site office at the excavation site. This must be done in conjunction with the appointed specialist and form part of the on-going revision of the EMPr during the excavation stage of the project:

1.1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period

1.2 Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any significant fossils are recorded during the time of excavation. Existing information exist and a site visit and clearance from the Palaeontologist, must be issued during the first site visit, which must fall within the first week of site activity. The first site visit will be followed up with subsequent e-mail communications.

Functional responsibilities of the appointed Palaeontologist

1. Establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata in collaboration with the ESI at WITS University and the National Museum in Bloemfontein.

2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations. A short training session of the ECO or a representative, was included in this first site visit to this project.

3. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the contractor management team, more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for major finds must briefly be agreed on.

4. Informal on-site training in responses applicable to “normal” fossil finds must be provided for the ECO and environmental staff by the appointed specialist. This step is needed, due to the discovery of significant fossils at the time of the site investigation (Phase 1 PIA).

5. Respond to significant finds and undertake appropriate mitigation.

6. Initially, for the first three months of operation, and only if the ECO indicates significant “strange looking rocks” that might be similar to the fossils indicated to the staff during the information session, visit at least once in two weeks to “touch base” with the monitoring progress. Document interim “normal” finds and undertake an inspection and documentation of new excavation faces. A strategy for further visits during the life of the excavation must be discussed.

7. Transport of material from the site to the ESI, WITS University or National Museum in Bloemfontein.

8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at ESI and the South African Heritage Resources Authority (SAHRA). It must fulfil the reporting standards and data requirements of these bodies.

9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

Exposure of palaeontological material

1. In the event of construction exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil find, the following procedure must be adhered to:

1.1 The appointed specialist or alternates (SAHRA; ESI WITS University, University of FS) must be notified by the responsible officer (e.g. the ECO or contractor manager), of major or unusual discoveries during excavation, found by the Contractor Staff.

1.2 Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the ESI at WITS University, or its designated representatives, have had reasonable opportunity to

investigate the find. Such work will be at the expense of the Developer (Eskom Holdings (Pty) Ltd).

Significant fossils were observed in this area and the palaeontologist must clear the continued excavation. Continued construction can proceed on the proviso that any suspicious material will be indicated to the Palaeontologist via emailed photographic information.

CONCLUSION

The development site for the Proposed Sorata-Witsieshoek (Eskom Holdings (Pty) Ltd) power line upgrade, Maluti-A-Phofung Local Municipality, Thabo Mofutsanyane District Municipality, Free State Province, falls on Highly significant shale and thin bands of sedimentary rocks (Normandien, Katberg and Burgersdorp Formations) and Moderately sensitive (alluvium) sediments, that might contain significant fossils. No fossils are expected in the dolerite.

Fossils have been recorded for years in these rock formations. The potential for finding significant micro-fossils mostly as trace fossils, as well as macro fossils in the form of plant and vertebrate remains, in any excavation into sediments of the Normandien, Katberg and Burgersdorp Formations, is always very high and the cooperation of the entire team at Sorata-Witsieshoek Power Line Upgrade Project is of critical importance. The interest and cooperation of the management team will be highly appreciated and it is essential that the excavation be monitored during the first week of excavation and that this "Chance Find Protocol" be updated on a monthly basis during the life-time of the excavation period for the project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the "Chance Find Protocol" on the SAHRIS Website for record purposes. No fossils will be associated with areas underlain by dolerite, but significant Quaternary aged fossils can be present in the alluvial cover on these geological formations.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity was allocated to the greater part of the development and due to the highly weathered nature of the material, significant fossils is only expected **after** the start of excavations for foundations.
- The allocated team members at the community need to be introduced to Palaeontological material that is likely to be found on site. A once-off information session with the Palaeontological specialist must be

arranged, to present a simple and understandable, preferably audio-visual presentation, in the “interpreted voice” of the majority of the contractual workers on site, during the initial site visit. This arrangement must form part of the EMPr for the project, with an appropriate budget allocation.

- This “Chance Find Protocol” needs to be included into the EMPr of the project and a reasonable budget need to be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The SAHRA must be informed of the content of this “Chance Find Protocol” and EMPr arrangements by the EAP, ECO and the developer, for final approval of the ROD documentation during the EIA process.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



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